Anemia Expert System Diagnosis Using Sl5 Object

Aldaour F. Ahmed, Samy S. Abu Naser

Department of Information Technology,
Faculty of Engineering & Information Technology,
Al-Azhar University, Gaza, Palestine

Abstract: Background: *Anemia is a condition that occurs due to a lower concentration of hemoglobin than the normal level (non-pregnant adult females less than 11 g / dL and males younger than 13 g / dL). Because of the low level of hemoglobin, the body's organs suffer from lack of enough oxygen, so patients complain of signs and symptoms such as fatigue, headaches, lack of concentration, lethargy and others.* **Objectives***: The main goal of this expert system is to get the appropriate diagnosis of disease.* **Methods***: In this paper the design of the proposed Expert System which was produced to help Doctor in diagnosing many of the anemia diseases such as : Fatigue, Chest pain, Shortness of breath, Swelling of the body, Pallor of skin. The proposed expert system presents an overview about anemia diseases are given, the cause of diseases are outlined. SL5 Expert System language was used for designing and implementing the proposed expert system.* **Results***: The proposed anemia diseases diagnosis expert system was evaluated by engineering students.*

Keywords: Artificial Intelligence, Expert Systems, Sl5, anemia diseases**.**

1. INTRODUCTION

Anemia is the most common disorder of the blood. The several kinds of anemia are produced by a variety of underlying causes. It can be classified in a variety of ways, based on the morphology of RBCs, underlying etiologic mechanisms, and discernible clinical spectra, to mention a few. The three main classes include excessive blood loss (acutely such as a hemorrhage or chronically through low-volume loss), excessive blood cell destruction (hemolysis) or deficient red blood cell production (ineffective hematopoiesis).
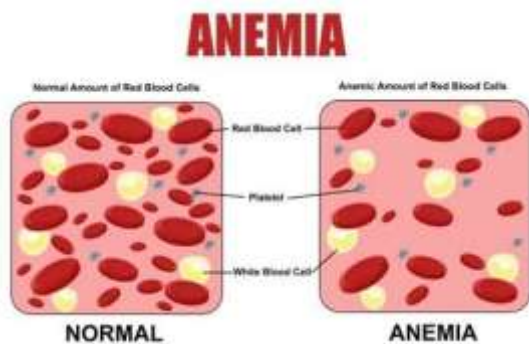

Figure 1: General form of anemia

2. EXPERT SYSTEM

In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code. The first expert systems were created in the 1970s and then proliferated in the 1980s.Expert systems were among the first truly successful forms of artificial intelligence (AI) software. An expert system is divided into two subsystems: the inference engine and the knowledge base. The knowledge base represents facts and rules. The inference engine applies the rules to the known facts to deduce new facts. Inference engines can also include explanation and debugging abilities.
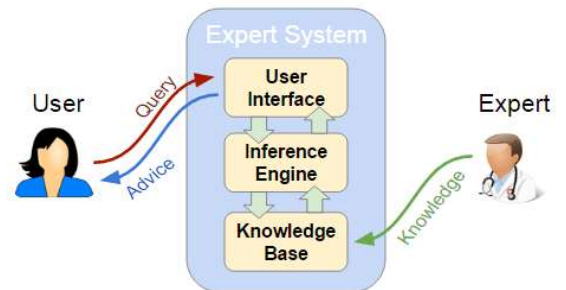

Figure 2: General form of expert system

3. MATERIALS AND METHODS

The proposed system of experts will diagnose five anemia diseases in stages of human life, from young people to the elderly through an expert system capable of identifying Kind of the disease. The proposed system of experts will ask the user to determine the symptoms of the disease in the symptoms screen.

Figure 3 illustrates a model for the symptom selection mechanism. Figure 4 shows how to identify the disease.
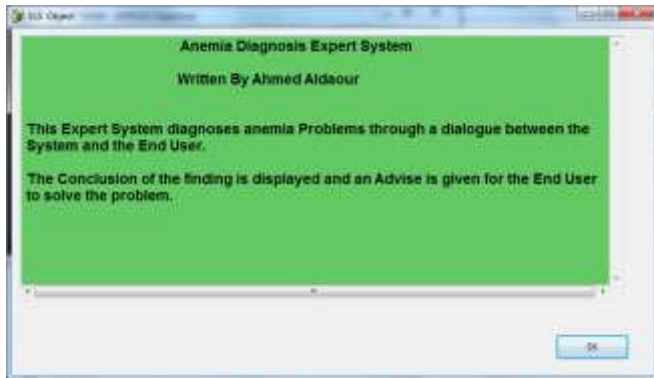
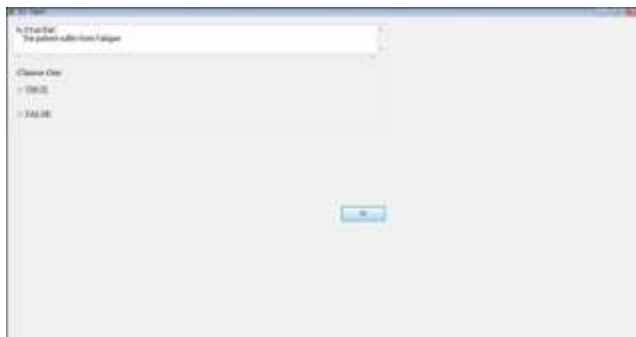**Figure 3**: First screen of the execution of the expert system

Figure 4: Screen selection of symptoms

Figure 5: Screen Disease Identification

4. LITERATURE REVIEW

There are many systems that have talked about diagnosing human diseases such as:

- An Expert System for Depression Diagnosis [15] to get the appropriate diagnosis of disease and the correct treatment and give the appropriate method of treatment through several tips that concern the disease and how to treat it.
- Knowledge Based System for Diabetes Diagnosis Using SL5 Object [53] to get the appropriate diagnosis of the illness, dealing with it quickly, and tips for permanent treatment whenever possible is given out.

- Hepatitis Expert System Diagnosis Using Sl5 Object [38] diagnoses the patient's condition and provides the appropriate solution.
- Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment [64] was made to aid internist physicians in diagnosing numerous of the abdomen diseases for example: gastritis, hiatal hernia, ulcer or heartburn; the proposed expert system offers a summary about abdomen diseases are given, the cause of diseases are drew and the cure of disease when possible is shown up.
- Expert System for Problems of Teeth and Gums [44] assist people with teeth and gums problems to diagnose their problems and receive a recommendation for the treatment. This knowledge based system was developed using SL5 Object language.
- Ear Diseases Diagnosis Expert System Using SL5 Object [40] swiftly diagnoses patient's condition and proposes a appropriate answer for the problem.
- An expert system for feeding problems in infants and children [43] to diagnose feeding problems in infants and children.
- Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System [46] to assist users in getting the correct diagnosis of the health problem of video game addictions that range from (Musculoskeletal issues, Vision problems and Obesity). Furthermore, this expert system delivers information about the problem and tells us how we can solve it.
- An expert system for men genital problems diagnosis and treatment [52] to assist men diagnose their genital problems and give them the suitable treatment. Genital problems and injuries usually occur through: recreational activities (such as: Basketball, Football, Hooky, Biking), work-related tasks (such as: contact to irritating chemicals), downhill drop, and sexual activities. SL5 Object expert system language was used to develop this expert system.
- An Expert System for Genital Problems in Infants [59] diagnoses genital problems in infants which is one of the most common problems that need quick intervention in the newly born stage.
- An expert system for nausea and vomiting problems in infants and children[62] to aid users in getting the right diagnosis of problems of nausea and vomiting in infants and children (Gastro-esophageal reflux, Gastroenteritis, Systemic Infection, Bowel obstruction, Tumors, A bleeding disease, tonsillitis, and Hepatitis pharynx). Additionally, this expert system offers information about the disease and how to deal with it.

- A Ruled Based System for Ear Problem Diagnosis and Treatment [55] was used to classify ear problems into three main sets: a- Inflammation of the inner ear b- Middle ear problems c- External ear problems.
- Lower Back Pain Expert System Diagnosis and Treatment [48] can be used to positively diagnose low back pain concentration.
- A Proposed Expert System for Foot Diseases Diagnosis [58] diagnoses eighteen foot problems of all phases of the human life beginning with baby to the grownup by examining with yes/no questions.
- A Knowledge Based System for Neck Pain Diagnosis [54] can diagnose seven neck diseases of different phases of the human life beginning by asking the user many questions according to their pain symptoms.
- An expert system for shoulder problems using CLIPS [65] can help in diagnosing shoulder problems.
- Expert system urination problems diagnosis [66] can diagnose some of the Urination diseases (Pyelonephritis, Kidney Stone, Bladder infection, Prostatitis, Urethritis, Gonorrhea, Interstitial cystitis, Stress incontinence, Trauma in kidney or bladder).
- A Proposed Rule Based System for Breasts Cancer Diagnosis [57] was developed to help people in preventing and early detecting breast cancer; since it is known that this disease does not have medication or cure yet.
- A Proposed Expert System for Skin Diseases Diagnosis [71] was developed using CLIPS(C Language Integrated Production System) to help user diagnose the following skin diseases (Psoriasis, Eczema, Ichthyosis, Acne, Meningitis, Measles, Scarlet Fever, Warts, Insect Bites and Stings).
- Male Infertility Expert System Diagnoses and Treatment [47] for male infertility diagnosis which helps men to explore everything related to the problems of infertility and infertility diseases such as: Azoospermia, O.T.A syndrome which mean oligo-terato-astheno spermia, Aspermia and Sexual transmitted disease.
- An Expert System for Mouth Problems in Infants and Children [63] ask the user to answer the questions about the symptoms of the patient and end up with some information about the disease and some advices telling the user how to deal with the baby.
- Knowledge Management in ESMDA: Expert System for Medical Diagnostic Assistance [13] deals with the design of a prototype expert system that assists patients to diagnose their diseases and offer them the suitable advice.

- Expert System for the Diagnosis of Seventh Nerve Inflammation (Bell's palsy) Disease [14] diagnosis the seven nerve inflammation which will help doctors to explore everything related to the problems of seventh nerve inflammation. We look forward to providing simplified answers to seven nerve inflammation.
- Knowledge Based System for the Diagnosis of Dengue Disease [12] to help doctors and patients in diagnosing Dengue Disease and give them the information of how to prevent Dengue Disease and to be able to understand the signs and symptoms of Dengue Disease.
- An Expert System for Arthritis Diseases Diagnosis Using SL5 Object[10]   to help Orthopedist in diagnosing Arthritis disease through its symptoms such as: pain on pressure in a joint, Inflammation indicated by joint swelling, Stiffness.
- A Proposed Expert System for Diagnosing Skin Cancer Using SL5 Object [68] quickly diagnose patient's condition and propose a suitable solution for the problem.
- Knowledge Based System for Ankle Diseases Diagnosis [51] recognized seven ankle diseases: Ankle Sprain, Fracture (of Fibula), Rheumatoid Arthritis, Rheumatoid Fever, Gout, and Osteoarthritis (Degenerative Joint) and they developed the expert system for those ankle diseases using SL5 Object Expert System Language.
- An Expert System for Diagnosing Shortness of Breath in Infants and Children [42] for diagnosing infants and children patients with twelve various shortness of breath in infants and children diseases.
- Polymyalgia Rheumatic Expert System [9] outlined an expert system for classification criteria for PMR, recent advances of diagnostic and therapeutic procedures.
- Expert System for Chest Pain in Infants and Children [58] to assist doctors, parents, and care giver in diagnosing chest pain in infants and children.
- Rickets Expert System Diagnoses and Treatment [47] assist doctors to discover everything connected to the problems of rickets.
- Expert System for Hair Loss Diagnosis and Treatment [70] for diagnosing eleven diverse hair loss diseases of the human stages from childhood to adults by asking questions with a Yes or No answer.

There is no specialized expert system for the diagnosis of Anemia available free and use SL5 Object language. This expert system is easy to use by doctors and patients.

5. REPRESENTATION OF KNOWLEDGE

The main sources of knowledge for this experts system are human experts in diagnosing anemia diseases. The captured knowledge has been converted into syntax using SL5 rules covering five anemia diseases:

Fatigue:

One of the most common symptoms of anemia is fatigue, which is a serious condition that goes beyond feeling a little sleepy when one doesn't get a good night's rest.

Fatigue is defined as extreme exhaustion or feeling so tired that it interferes with normal activities. Although fatigue can be caused by many things, when anemia is severe, it may make one feel so tired that he or she can't live the life they want to. When left untreated, anemia can result in chronic fatigue and put the body at risk of developing other health conditions.

Figure 6: Fatigue symptoms

Chest Pain:

Chest pain may arise and subside every few minutes or over several days. The cause may be related to the heart, the muscles, the digestive system, or psychological factors.

Underlying causes of chest pain may be mild, as in the case of acid reflux. Or, they may be serious and indicate, for example, a heart attack. It is important to recognize warning signs and look for accompanying symptoms.

Figure 7: Chest Pain symptoms

Shortness of Breath:

Most causes of shortness of breath are due to heart and lung conditions. Your heart and lungs are involved in transporting oxygen to your body and removing carbon dioxide, and problems with either of these processes affect your breathing.

Breathing is regulated by the brain and a complex interaction between various chemicals in the blood and in the air that we breathe. Oxygen levels, carbon dioxide levels, and the amount of hemoglobin in blood play a role. If blood carbon dioxide levels rise, the brain tells the body to increase the breathing rate, which can result in deeper or faster breaths. This may lead to a sensation of difficulty breathing. Likewise, too much acid in the blood from an infection, lactic acid build-up or other causes can lead to an increase in the breathing rate and the sensation of shortness of breath.

Figure 8: Shortness Of Breath symptoms

Swelling of the Body:

In general, swelling is any abnormal enlargement of a body part. This can be due to fluid - including blood - bony malformation, muscle, or any number of things. Edema describes fluid, or swelling, that has accumulated in the tissue outside of your joint capsule. This includes swelling in your calf or thigh. Effusion describes fluid that is inside your joint capsule, such as a swollen ankle or knee. Hemarthrosis is a condition where there is blood in the effusion within your joint capsule and indicates either a ligamentous injury, such as an ACL tear, or a fracture. This is determined by extracting some fluid from the joint capsule with a needle.

Figure 9: Swelling Of The Body symptoms

Pallor of Skin:

Pallor is a pale color of the skin that can be caused by illness, emotional shock or stress, stimulant use, or anemia, and is the result of a reduced amount of oxyhaemoglobin and is visible in skin conjuctivae or mucous membrane.

Pallor is more evident on the face and palms. It can develop suddenly or gradually, depending on the cause. It is not usually clinically significant unless it is accompanied by a general pallor (pale lips, tongue, palms, mouth and other regions with mucous membranes). It is distinguished from similar presentations such as hypopigmentation (lack or loss of skin pigment) or simply a fair complexion.

Figure 10: Pallor Of Skin symptoms

6. LIMITATIONS

The current system of experts specializes in diagnosing only 5 diseases.

7. CONCLUSION

In this paper, a proposed expert system was introduced to assist physicians in diagnosing patients with 5 different anemia diseases. This expert system does not require extensive training to use; it is easy to use and has an easy-to-use interface. It was developed using SL5 language.

Future work

This system of experts is a basis for the future. It is planned to add more anemia diseases and make them more accessible to users from anywhere and at any time.

8. EXPERT SYSTEM SOURCE CODE

```
 !Written by Ahmed Aldaou

ATTRIBUTE start SIMPLE

ATTRIBUTE The patient suffer from Fatigue SIMPLE

ATTRIBUTE The patient suffer from Chest pain SIMPLE

ATTRIBUTE The patient suffer from Shortness of breath
SIMPLE

ATTRIBUTE The patient suffer from Swelling of the body
SIMPLE

ATTRIBUTE The patient suffer from Pallor of skin SIMPLE

INSTANCE the domain ISA domain
   WITH start := TRUE

INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display :=  Conc

INSTANCE introduction ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1 ] := textbox 1

INSTANCE textbox 1 ISA textbox
  WITH location := 10,10,800,350
  WITH pen color := 0,0,0
  WITH fill color := 100,200,100
  WITH justify IS left
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text "=:

                    Anemia Diagnosis Expert System

                    Written By Ahmed Aldaour


This Expert System diagnoses anemia Problems through a
dialogue between the
System and the End User  .
```

The Conclusion of the finding is displayed and an Advise is given for the End User to solve the problem".

INSTANCE Conc ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := title textbox
  WITH items [2] := problem textbox
  WITH items [3] := advise textbox

INSTANCE title textbox ISA textbox
  WITH location := 20,10,800,70
  WITH pen color := 0,0,0
  WITH fill color := 200,200,100
  WITH justify IS center
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text := " The Conclusion of the anemia Diagnosis Expert System"

INSTANCE problem textbox ISA textbox
  WITH location := 20,110,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text"--===-- "=:

INSTANCE advise textbox ISA textbox
  WITH location := 20,280,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text"--===-- "=:

RULE R0
IF start
THEN ASK The patient suffer from Fatigue

RULE R1
IF The patient suffer from Fatigue
THEN ASK The patient suffer from Chest pain

RULE R2
IF The patient suffer from Fatigue
AND The patient suffer from Chest pain
THEN ASK The patient suffer from Shortness of breath

RULE R3
IF The patient suffer from Fatigue
AND The patient suffer from Chest pain
AND The patient suffer from Shortness of breath

THEN ASK The patient suffer from Swelling of the body

RULE R4
IF The patient suffer from Fatigue
AND The patient suffer from Chest pain
AND The patient suffer from Shortness of breath
AND The patient suffer from Swelling of the body
THEN ASK The patient suffer from Pallor of skin

RULE R13
IF The patient suffer from Fatigue
AND The patient suffer from Chest pain
AND The patient suffer from Shortness of breath
AND The patient suffer from Swelling of the body
AND The patient suffer from Pallor of skin
THEN text OF problem textbox := "The patient suffer form anemia".
AND text OF advise textbox := "The Advice: Go to your doctor for the treatment CF 100%"
ELSE text OF problem textbox := "The patient does not suffer form anemia".
AND text OF advise textbox := "The Advice: Keep the good health"

END

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